

IN THE CLAIMS:

Please amend the claims as follows:

1. (Withdrawn): A method for preparing a chemical solution, comprising the steps of:

dissolving a chemical gas in a liquid to prepare the chemical solution, wherein the liquid is pure water or a mixture having a predetermined composition; and

discharging at least either one of an adjusted amount of the chemical gas that was not dissolved in the liquid and a predetermined amount of the chemical solution, wherein the dissolving step and the discharging step are performed at substantially the same time.

2. (Withdrawn): The method according to claim 1, wherein the dissolving step includes forming a swirl of fine bubbles of the chemical gas in the liquid.

3. (Withdrawn): The method according to claim 2, wherein the dissolving step includes ejecting the bubbles in a direction inclined relative to a vertical direction.

4. (Withdrawn): The method according to claim 1, wherein the dissolving step includes cooling the liquid.

5. (Withdrawn): The method according to claim 1, wherein the discharging step

includes forming bubbles of the chemical gas that was not dissolved by the dissolving step to return the undissolved chemical gas to the liquid.

6. (Withdrawn): The method according to claim 1, wherein the discharging step includes reintroducing the chemical gas that was not dissolved by the dissolving step to the liquid when the concentration of the undissolved chemical gas is equal to or greater than a predetermined value.

7. (Withdrawn): The method according to claim 1, wherein used chemical gas disposed of by a facility for fabricating electronic device is dissolved in the liquid in the dissolving step.

8. (Withdrawn): The method according to claim 1, further comprising the steps of:  
collecting chemical gas from used chemical solution disposed of by a facility for fabricating electronic devices; and  
supplying the collected chemical gas to the liquid.

9. (Withdrawn): The method according to claim 8, wherein the collecting step includes at least one of heating the chemical solution and forming inert gas bubbles in the chemical solution.

10. (Withdrawn): The method according to claim 1, wherein the chemical gas includes at least one of a group consisting of ammonia gas, hydrogen fluoride gas, hydrogen sulfide gas, and hydrogen chloride gas.

11. (Withdrawn): The method according to claim 1, wherein the chemical gas is ammonia gas, and the chemical solution includes at least one of a group consisting of ammonia water, a mixture of ammonia water and hydrogen peroxide, and a mixture of ammonium fluoride and hydrofluoric acid.

12. (Canceled):

13. (Currently amended): A chemical solution preparation apparatus comprising a chemical solution refinement device, which dissolves a chemical gas into a liquid and prepares a refined chemical solution, wherein the liquid is one of pure water or a mixture having a predetermined composition, the chemical solution refinement device including:

a preparation tank for storing the liquid;

a first pipe for supplying the chemical gas into the preparation tank;

a first valve arranged in the first pipe for opening and closing the first pipe;

a second ~~valve~~ pipe for discharging the chemical gas that was not dissolved in the liquid during the gas dissolving from the preparation tank;

a second valve arranged in the second pipe for opening and closing the second

pipe:

a third ~~valve~~ pipe for discharging a predetermined amount of the chemical solution from the preparation tank during the gas dissolving to increase the purity of the chemical solution;

a third valve arranged in the third pipe for opening and closing the third pipe; and

a controller for operating the first, second and third valves, wherein when the controller programmed to operate ~~operates~~ the first valve to supply the chemical gas to the preparation tank, the controller programmed to operate ~~operates~~ the second valve and the third valve to continuously and simultaneously discharge an adjusted amount of the undissolved chemical gas and a predetermined amount of the chemical solution that is under preparation from the preparation tank.

14. (Previously presented): The preparation apparatus according to claim 13, wherein the chemical solution refinement device further includes a bubbler element for forming bubbles of the chemical gas in the preparation tank to dissolve the chemical gas in the liquid.

15. (Previously presented): The preparation apparatus according to claim 13, wherein the chemical solution refinement device further includes a flow controller arranged in the first pipe.

16. (Previously presented): The preparation apparatus according to claim 14, further comprising a cooling unit for cooling the liquid in the preparation tank.

17. (Currently amended): A chemical solution preparation apparatus comprising a chemical solution refinement device, which dissolves a chemical gas into a liquid and prepares a refined chemical solution, wherein the liquid is one of pure water or a mixture having a predetermined composition, the chemical solution refinement device including:

a preparation tank for storing the liquid;

a gas supply line for supplying the chemical gas to the preparation tank;

a liquid supply line for supplying the liquid to the preparation tank;

a first valve arranged in the gas supply line for opening and closing the gas supply line;

a bubbler element connected to the gas supply line for forming bubbles of the chemical gas in the preparation tank to dissolve the chemical gas in the liquid;

a second ~~valve~~ pipe for discharging an adjusted amount of the chemical gas that was not dissolved in the liquid from the preparation tank;

a second valve arranged in the second pipe for opening and closing the second pipe;

a third ~~valve~~ pipe for discharging a predetermined amount of the chemical solution from the preparation tank;

a third valve arranged in the third pipe for opening and closing the third pipe;

a controller for simultaneously operating the first, second and third valves; and  
a cooling unit for cooling the liquid in the preparation tank, wherein the cooling unit includes a pump for circulating the chemical solution between the preparation tank and a second pipe and a cooling element connected to the second pipe.

18. (Currently amended): A chemical solution preparation apparatus comprising a chemical solution refinement device, which dissolves a chemical gas into a liquid and prepares a refined chemical solution, wherein the liquid is one of pure water or a mixture having a predetermined composition, the chemical solution refinement device including:

a preparation tank for storing the liquid;  
a gas supply line for supplying the chemical gas to the preparation tank;  
a liquid supply line for supplying the liquid to the preparation tank;  
a first valve arranged in the gas supply line for opening and closing the gas supply line;

a bubbler element connected to the gas supply line for forming bubbles of the chemical gas in the preparation tank to dissolve the chemical gas in the liquid;

a gas discharge line ~~second valve~~ for discharging an adjusted amount of the chemical gas that was not dissolved in the liquid from the preparation tank;

a second valve arranged in the gas discharge line for opening and closing the gas discharge line;

a chemical solution discharge line ~~third valve~~ for discharging a predetermined

amount of the chemical solution from the preparation tank;

a third valve arranged in the chemical solution discharge line for opening and closing the chemical solution discharge line;

a cooling unit for cooling the liquid in the preparation tank, wherein the cooling unit includes a cooling element connected to the preparation tank and a pump for circulating the chemical solution between the preparation tank and the cooling element.

19. (Currently amended): A chemical solution preparation apparatus comprising a chemical solution refinement device, which dissolves a chemical gas into a liquid and prepares a refined chemical solution, wherein the liquid is one of pure water or a mixture having a predetermined composition, the chemical solution refinement device including:

a preparation tank for storing the liquid;

a gas supply line for supplying the chemical gas to the preparation tank;

a liquid supply line for supplying the liquid to the preparation tank;

a first valve arranged in the gas supply line for opening and closing the gas supply line;

for forming bubbles of the chemical gas in the preparation tank to dissolve the chemical gas in the liquid;

a gas discharge line ~~second valve~~ for discharging an adjusted amount of the chemical gas that was not dissolved in the liquid from the preparation tank;

a second valve arranged in the gas discharge line for opening and closing the gas

discharge line;

a chemical solution discharge line ~~third valve~~ for discharging a predetermined amount of the chemical solution from the preparation tank;

a third valve arranged in the chemical solution discharge line for opening and closing the chemical solution discharge line;

a controller for simultaneously operating the first, second and third valves;

a cooling unit for cooling the liquid in the preparation tank; and

a gas cylinder containing liquefied chemical gas, wherein the cooling unit includes a heat exchanger for exchanging heat between the gas cylinder and the preparation tank.

20. (Previously presented): The preparation apparatus according to claim 14, wherein the bubbler element has a nozzle for forming fine bubbles of the chemical gas.

21. (Original): The preparation apparatus according to claim 20, wherein the nozzle is inclined by a predetermined angle relative to a vertical direction.

22. (Original): The preparation apparatus according to claim 20, wherein the nozzle extends vertically, and the bubbler element further includes a deflection plate for guiding the bubbles in a predetermined direction.

23. (Original): The preparation apparatus according to claim 13, further comprising:



a concentration measuring device for measuring the concentration of the chemical solution; and

a concentration adjusting device for adjusting the concentration of the chemical solution in accordance with the measured result of the concentration measuring device.

24. (Currently amended): A chemical solution preparation apparatus comprising a chemical solution refinement device, which dissolves a chemical gas into a liquid and prepares a refined chemical solution, wherein the liquid is one of pure water or a mixture having a predetermined composition, the chemical solution refinement device including:

a preparation tank for storing the liquid;

a gas supply line for supplying the chemical gas to the preparation tank;

a liquid supply line for supplying the liquid to the preparation tank;

a first valve arranged in the gas supply line for opening and closing the gas supply line;

a gas discharge line ~~second valve~~ for discharging an adjusted amount of the chemical gas that was not dissolved in the liquid from the preparation tank;

a second valve arranged in the gas discharge line for opening and closing the gas discharge line;

a chemical solution discharge line ~~third valve~~ for discharging a predetermined amount of the chemical solution from the preparation tank;

a third valve arranged in the chemical solution discharge line for opening and closing

the chemical solution discharge line;

a concentration measuring device for measuring the concentration of the chemical solution, wherein the concentration measuring device includes at least one of a viscosity meter, a specific gravity meter, an ultrasonic wave velocity meter, and a specific conductance meter; and

a concentration adjusting device for adjusting the concentration of the chemical solution in accordance with the measured result of the concentration measuring device, wherein the concentration adjusting device includes a controller for calculating the concentration of the chemical solution from the measured result of the concentration measuring device and controlling the amount of the chemical gas supplied to the preparation tank from the gas supply line in accordance with the calculated concentration, and wherein when the controller operates the first valve to supply the chemical gas to the preparation tank, the controller operates the second valve and the third valve to discharge an adjusted amount of the undissolved chemical gas and a predetermined amount of the chemical solution that is under preparation from the preparation tank.

25. (Original): The preparation apparatus according to claim 24, wherein the concentration measuring device measures the heat of reaction during dissolution of the chemical gas with a thermometer and calculates the amount of dissolved chemical gas from the measured result to obtain the concentration of the chemical solution.

26. (Previously presented): The preparation apparatus according to claim 24, wherein the gas supply line includes a container in which the chemical gas is contained, and wherein the concentration measuring device calculates the amount of the used chemical gas by measuring the change in the weight of the container and calculates the concentration of the chemical solution from the amount of the used chemical gas.

27. (Original): The preparation apparatus according to claim 13, further comprising an ice particle generator for generating ice particles, and wherein the dissolution unit causes contact between the ice particles and the chemical gas to dissolve the chemical gas in the liquid.

28. (Original): The preparation apparatus according to claim 13, further comprising a gas purification unit for purifying the chemical gas with pure water.

29. (Currently amended): A chemical solution preparation apparatus comprising a chemical solution refinement device, which dissolves a chemical gas into a liquid and prepares a refined chemical solution, wherein the liquid is one of pure water or a mixture having a predetermined composition, the chemical solution refinement device including:

a gas supply line for supplying the chemical gas;

a first valve arranged in the gas supply line for opening and closing the gas supply line;

a cooling unit connected to the gas supply line for storing and cooling the liquid during the preparation of the chemical solution;

a tank for storing the chemical solution received from the cooling unit;

a gas discharge line ~~second valve~~ for discharging an adjusted amount of the chemical gas that was not dissolved in the liquid during the gas dissolving from the cooling unit;

a second valve arranged in the gas discharge line for opening and closing the gas discharge line;

a chemical solution discharge line ~~third valve~~ for discharging a predetermined amount of the chemical solution from the tank;

a third valve arranged in the chemical solution discharge line for opening and closing the chemical solution discharge line; and

a controller for operating the first, second and third valves, wherein when the controller operates the first valve to supply the chemical gas to the preparation tank, the controller operates the second valve and the third valve to continuously and simultaneously discharge an adjusted amount of the undissolved chemical gas from the cooling unit, and ~~wherein the controller operates the third valve~~ to discharge a predetermined amount of the chemical solution from the tank.

30. (Previously presented): The preparation apparatus according to claim 29, wherein the chemical solution refinement device is connected to a facility for fabricating

electronic devices to dissolve used chemical gas disposed of by the fabrication facility in the liquid.

31. (Original): The preparation apparatus according to claim 30, further comprising a gas purification unit for purifying the chemical gas with pure water and providing the purified chemical gas to the fabrication facility.

32. (Previously presented): A chemical solution preparation apparatus comprising:  
a chemical solution refinement device, which dissolves a chemical gas into a liquid and prepares a refined chemical solution and cools the chemical solution during the preparation, wherein the liquid is one of pure water or a mixture having a predetermined composition; and

a gas collection unit connected to the chemical solution refinement device and a facility for fabricating electronic devices, wherein the gas collection unit collects chemical gas from used chemical solution disposed of by the fabrication facility, and supplies the collected chemical gas to the chemical solution refinement device.

33. (Previously presented): The preparation apparatus according to claim 32, wherein the gas collection unit for collecting the chemical gas includes at least one of means for heating the used chemical solution and means for forming inert gas bubbles in the used chemical solution.

34. (Previously presented): The preparation apparatus according to claim 29, further comprising a flow controller arranged in the gas supply line.

35. (Previously presented): The preparation apparatus according to claim 29, wherein the chemical gas is contained in a predetermined container, and wherein the chemical solution refinement device includes means for measuring the weight of the chemical gas in the container so as to calculate the amount of the chemical gas supplied to the preparation tank.

36. (Previously presented): The preparation apparatus according to claim 29, wherein the chemical solution refinement device includes a hydrophobic filter for separating undissolved chemical gas from the chemical solution discharged from the cooling unit, the separated chemical gas being supplied to the cooling unit.

37. (Original): The preparation apparatus according to claim 29, further comprising a concentration measuring device for extracting some of the chemical solution during the preparation and measuring the concentration of the chemical solution, the concentration of the chemical solution being adjusted to a predetermined concentration by supplying the chemical gas to the chemical solution during preparation.

38. (Original): The preparation apparatus according to claim 29, further comprising

a raw material supplying device for supplying a raw material that differs from the chemical gas to the prepared chemical solution.

39. (Canceled):

40. (Canceled):

41. (Currently amended): The preparation apparatus according to claim 13, wherein when preparing the chemical solution, the controller is programmed to open ~~opens~~ the first, second, and third valves.

42. (Currently amended): The preparation apparatus according to claim 23, wherein the controller is programmed to keep ~~keeps~~ the second and third valves opened to continuously discharge the undissolved chemical gas and the chemical solution from the preparation tank until the concentration of the chemical solution contained in the preparation tank reaches a target value.

43. (Currently amended): The preparation apparatus according to claim 23, wherein when the impurities are eliminated from the chemical solution and the concentration of the chemical solution contained in the preparation tank reaches a target value, the controller is programmed to simultaneously ~~closes~~ close the first valve, the

second valve and the third valve to stop supplying the chemical gas and to stop discharging the undissolved chemical gas and the chemical solution from the preparation tank.